Aerated Lagoons

Ponding water in wetland

Plant diversity in wetland

Receiving water body

Calhan Facility Statistics	
Nearest Town:	**Calhan**
County:	**El Paso**
River Basin:	**Lower Arkansas**
Receiving Water Body:	**Tributary to Big Sandy Creek**
Year On-line:	**1996**
Population:	**850**
Elevation (feet):	**6541**
Design Flow (mgd):	**0.080**
Average Flow (mgd):	**0.065**
Size (acres):	**0.31**

Facility Description

The Calhan wastewater treatment facility is a minor municipal aerated lagoon system. This system consists of two complete-mix, mechanically aerated lagoons, one facultative lagoon, and an artificial wetland. Subsurface wetlands were included in this wastewater treatment facility to remove suspended solids from

lagoon effluent and to prevent algal blooms in the flood control reservoirs that receive effluent from this facility.

Lagoons

Some features of the Calhan lagoon system are detailed in the table below.

Lagoon Information			
Cell No.:	**1**	**2**	**3**
Surface Area (sq. ft.)	**11,800**	**11,800**	**11,800**
Avg. Depth (ft)	**12**	**12**	**12**
Avg. Volume (Million gallons)	**0.536**	**0.536**	**0.536**
Detention time (days)	**6.7**	**6.7**	**6.7**
Aerator size (hp)	**14**	**14**	**NA**

Background Information

The Calhan wastewater treatment facility is a new system. Constructed treatment wetlands were included as a component of the aerated lagoon system in order to provide final polishing before discharge from the site. The wetland cells were designed to be subsurface flow systems. At the time of the site visit, the water was flowing at about 3" above the gravel surface.

Energy Analysis:

Energy consumption at this site is minimal. The aerated lagoons operate 2-7.5 hp aerators.

Wetland Design

Design Methods

The wetland size was based on regression analysis of 14 full scale systems. In addition, design data from the Las Animas study[1] were used as a guide. Based on this empirical data, a gravel size of ¾" and a void space in the soil media of 28% were used. In addition, it was determined from this data, that a hydraulic retention time of 2.1 days would be sufficient to meet design requirements.

Objectives

This system was designed to reduce TSS in the lagoon effluent. Effluent from the lagoon was determined to range from 30 to 60 mg/l, with a peak effluent TSS of 250 mg/l in summer months, due to algal carryover. The wetland cells were designed to have 36-inch deep beds in consideration of freezing temperatures.

[1] "Subsurface Flow Wetlands – A Performance Evaluation", Water Environment Research, Vol.67, No.2.

Size

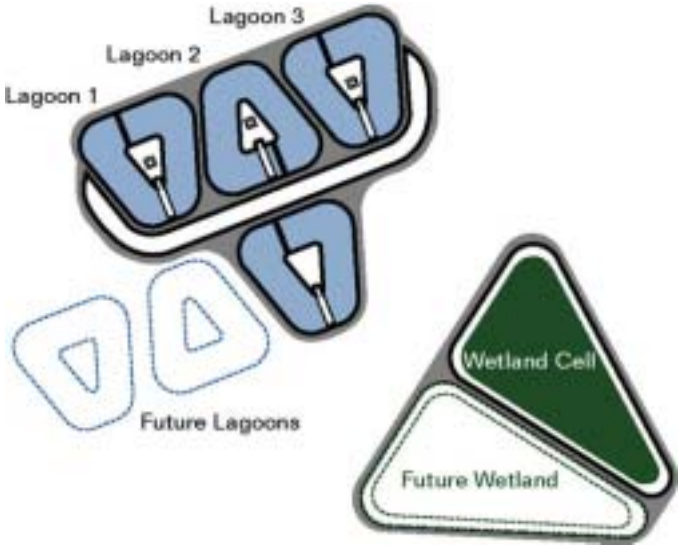
The subsurface wetland system consists of two cells with a surface area of 0.31 acres each. The depth of the soil media is 3feet. 1500 cubic yards of ¾ -inch rock provide a void space of 28%.

Shape

The wetlands are roughly triangular, with the inlet wider than the outlet width.

Hydraulics

Slotted pipe is used to convey water from the lagoons to the wetland cells. A 2'x4' water level control is used at this site. No lining was used since the natural soils are clayey. It is noted that the system has settled about 8" to 1' into the clay. This system was designed as a subsurface flow system, but due to settling of the system and possibly plugging, the system operates as a free water surface wetland.



Treatment Goals

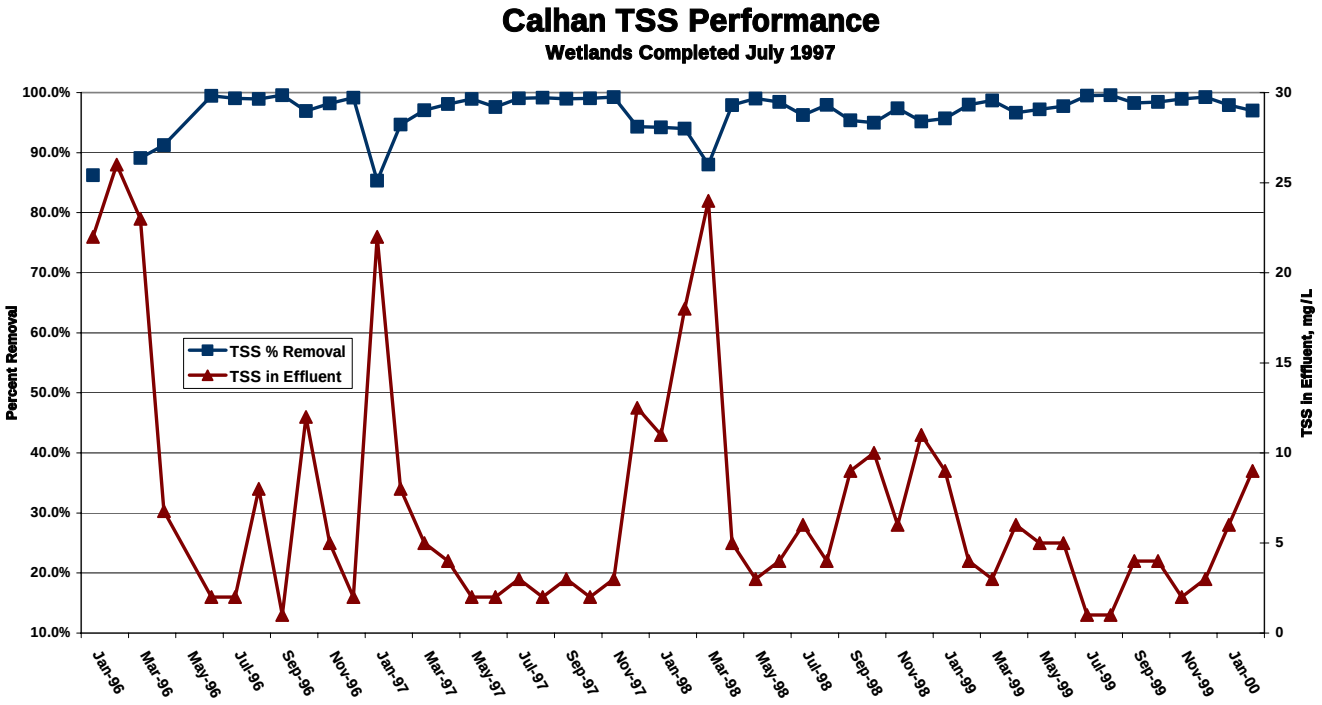
Permitted Discharge Limitations	
Oil and Grease:	**10 mg/l (Daily Max)**
$CBOD_5$:	**30 mg/l (30-day ave)**
BOD_5 Removal:	**85%**
TSS:	**75 mg/l (30-day ave)**
PH, su (min – max)	**6.5 – 9.0 (Daily Max)**
Chlorine Residual:	**0.5 mg/l (Daily Max)**
Fecal Coliform Bacteria:	**2,000 organisms per 100 ml (Daily Max)**

Water Quality Data

Water quality data were obtained from CDPHE permit files. Since the wetland implementation in 1997, the Calhan Wastewater Treatment Facility has consistently met its discharge permit requirements.

TSS Data

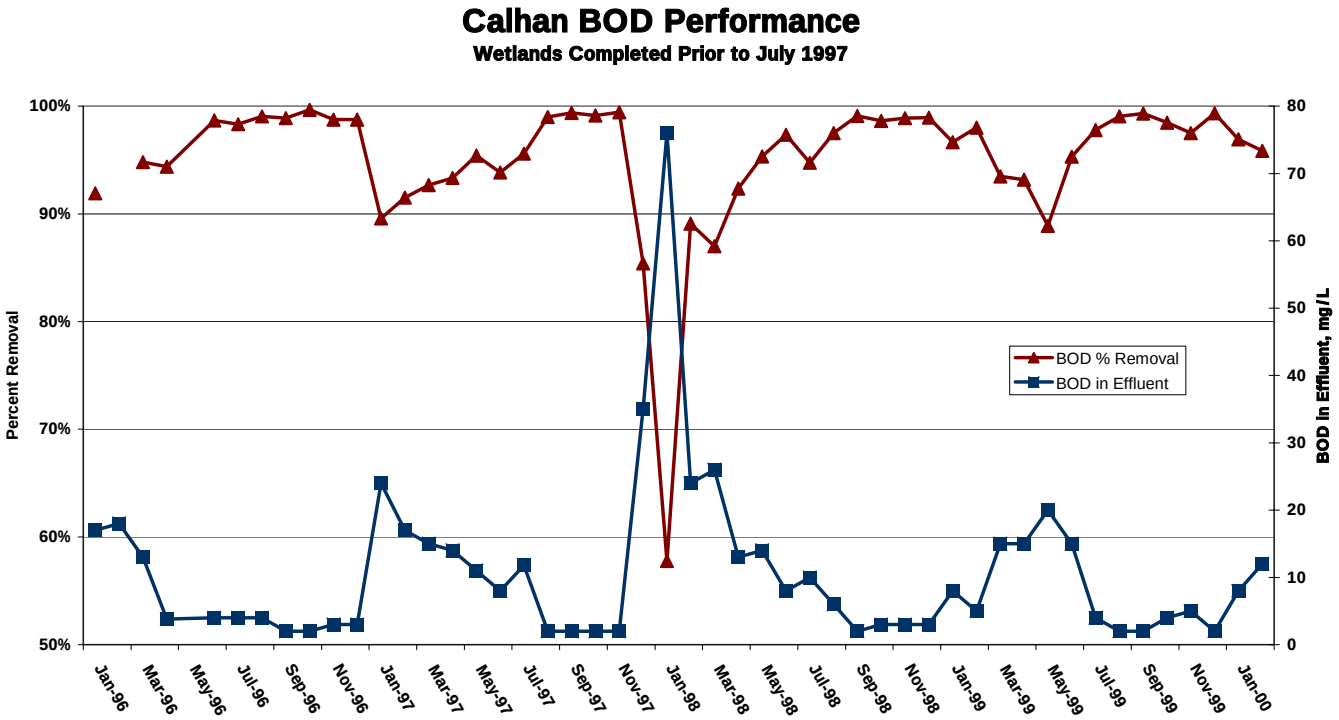
The TSS graph plots the percent removal on the left axis and TSS in mg/l in the effluent on the right axis. Some general observations can be made by reviewing the plotted 30-day average TSS data. Since the wetland system has come online, the average monthly TSS in the influent to the facility has been 241 mg/l



and the average monthly TSS in the effluent has been 6 mg/l. Peaks in the system correlate with the annual Watermelon Festival, which brings large crowds to the area.

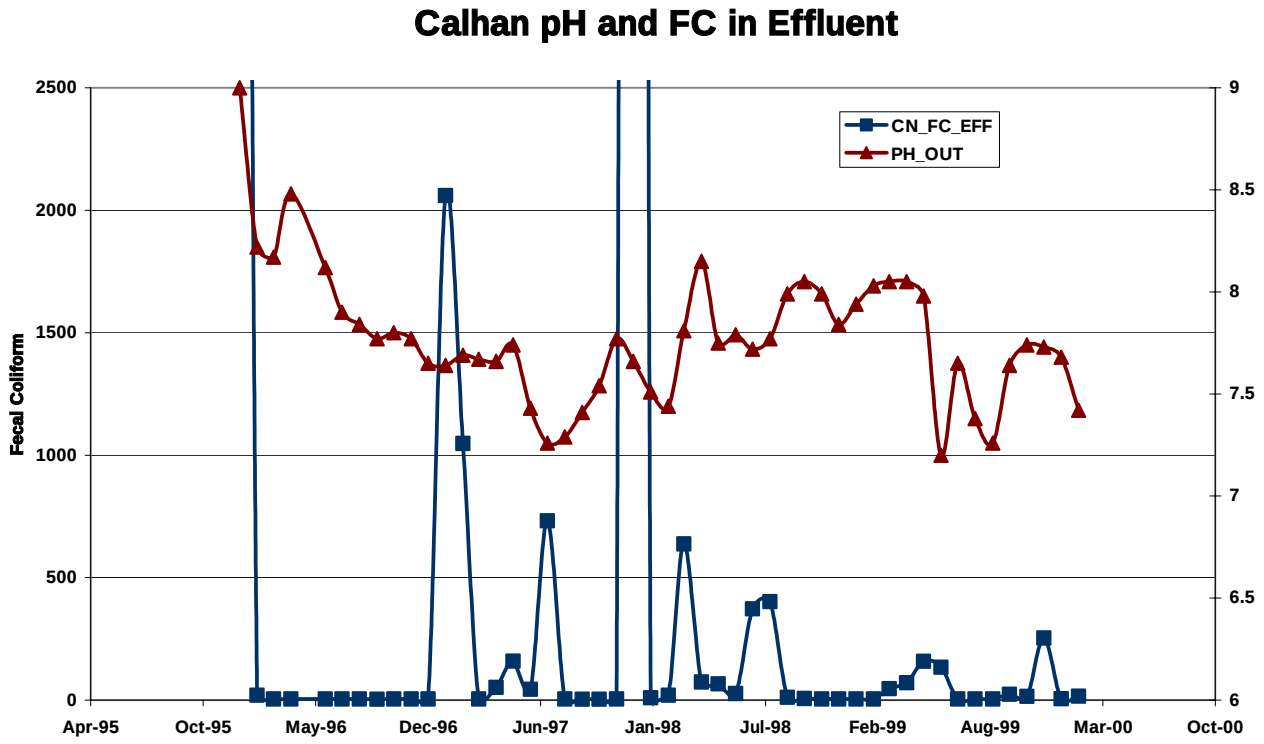
BOD Data

The BOD data is plotted similarly to the TSS data, with mg/l in the effluent on the right axis, and percent removal on the left axis. The average monthly BOD in the influent has been 245 mg/l and the average BOD in the effluent has been 11 mg/l.



pH and Fecal Coliform

Data for these two categories has been plotted on the same graph. Data reflect the quality of the effluent; no influent measurements are taken for these parameters. The pH values plotted are an average of the minimum and maximum 30-day values that are reported in the monthly reports. Since the wetland implementation, pH values have consistently stayed within the allowable range of 6.5 to 9. Previous to the wetland implementation, the fecal coliform values fluctuated considerably. Since the wetland implementation, the fecal coliform values have consistently met permit requirements.



General Ecological Setting

The Calhan constructed wetland cell is flat and rectangular. It has an area of approximately 0.7 acre. The wetland discharges to an unnamed tributary to Big Sandy Creek. The wetland is located northeast of the town of Calhan in a rangeland area.

Cell Vegetation

The Calhan wetland is comprised of a single wetland cell with two plant communities. The cell is composed of 30 percent water, 20 percent rock, and 50 percent vegetation. Plant community 1, which is 60 percent of the vegetated wetland area, is dominated by cattail (*Typha latifolia*), duckweed (*Lemna minor*), and barnyard grass (*Echinochloa crus-galli*), with a few foxtail barley (*Hordeum jubatum*. Plant community 2, which comprises 40 percent of the vegetated area, is dominated by pinkweed (*Polygonum pensylvanica*), curly dock (*Rumex crispus*), and Canada thistle (*Cirsium arvense*), with plains cottonwood (*Populus deltoides*), crack willow (*Salix fragilis*), and prickly lettuce (*Lactuca seriola*) present but not dominant.

Planting/Seeding

Cattails were planted at the site.

Weeds

Canada thistle is present in plant community 2. A State Noxious Weed, Canada thistle is particularly invasive in areas of recent disturbance, and spreads quickly. It prevents the establishment of, or displaces, native species and has low value as wildlife habitat.

Wildlife

The Calhan wetland provides habitat for muskrat, deer, pronghorn, songbirds, waterfowl, and mudpuppies. Teal, red winged black birds, and killdeer were observed during the site visit. This wetland has fairly high structural diversity, because it contains areas of open water, two plant communities, and areas of open gravel. The diversity is maintained in part because the water surface elevation is not consistent.

No muskrats have invaded the wetland area, although muskrats have been observed in the adjacent receiving pond. A fence is provided to prevent intrusion by antelope and cows from the adjacent ranch.

Wetland Biodiversity Functional Assessment

Sediment/nutrient/toxicant removal rated high. General wildlife habitat and production export/food chain support rated moderate. Habitat diversity and uniqueness of the constructed wetland rated moderate to low. This wetland received 43 percent of the possible functional points. It rated as a category III wetland.

Wetland Biodiversity Functional Assessment.

Function and Value Variables	Functional Points (0.1 to 1)	Possible Points
General Wildlife Habitat	0.5 (mod.)	1
General Fish/Aquatic Habitat	0.0	1
Production Export/Food Chain Support	0.7 (mod.)	1
Habitat Diversity	0.2 (low)	1
Uniqueness	0.2 (low)	1
Total Points	2.6 (52%)	5
Wetland Category (I, II, III, or IV)	III	

Human Use

The wastewater wetland is part of a restricted public access area. The site has been used for educational purposes during field trips by local 4th graders. This wetland has high aesthetic value because it is well maintained and because of its situation on the landscape. The outflow from the wetland flows through a draw, supporting riparian vegetation, then into a stock pond, both the draw and the stock pond provide valuable habitat.

Maintenance Issues

The site will be harvested for the first time this year. The primary maintenance issue noted is the weed control.

Overall Site Comments

This wetland is functioning well, and provides a mosaic of vegetation types, open water, and bare areas. The draw and stockpond into which water from this wetland flows add greatly to the biological and aesthetic value of this treatment wetland. Even though this system does not operate as designed, it does consistently meet its permit requirements.